Relativistic Heavy Ion Collider
Magnet Division Procedure

Proc. No.: RHIC-MAG-M-7562

Issue Date: May 24, 1991

Rev. No.: E

Rev. Date: June 23, 1994

Class: Ancillary Specifications
Title: Helium Mass Spectrometer Leak Testing Specification

- Cognizant Engineer: Signature on File
  BNL Engineering Division
- Approved by: Signature on File
  Head, BNL Engineering Division
- Quality Assurance: Signature on File

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval	QA
A	10/4/91	3	Bring Specification to Current Practice.	On file	On file
B	7/22/92	2,3	Paragraph 3.1E - changed 1 x 10^{-10}		
			to 2 x 10^{-12}. Paragraph 4.1.1 - changed		
			leak $\leq 10^{-10}$ to 2 x 10^{-12}. ECN #MG00148.	On file	On file
C	8/27/92	1	Reference Specification as Per ECN# MG00164.	On file	On file
			Note: ECN# MG00148 is obsolute.		
D	1/21/94		Changes per ECN #MG00572	On file	On file
E	6/23/94		Changes per ECN #MG00354	On file	On file

1. Scope:

The purpose of this specification is define the methods to be used to leak check all appropriate RHIC dipole magnet equipment and hardware, as specified on each particular engineering drawing.

2. Applicable Documents:

2.1 ASTM Specification E 425-90, "Standard Terminology Relating to Leak Testing", Vol. 03.03 Nondestructive Testing.

2.2 ASTM Specification E 498-73 (Reapproved 1980), "Standard Methods of Testing for Leaks Using the Mass Spectrometer Leak Detector or Residual Gas Analyzer in the Tracer Probe Mode", Method A.

2.3 Current drawings of the above RHIC Magnet and beam tube hardware.

3. Special Jigs, Fixtures, Materials and Equipment: The Supplier is responsible to provide for all test equipment, jigs, fixtures, etc., and for performance of all testing.

3.1 Vacuum Vessel-Weldment [Drawing No. 12065014 (Arc), 12060022 (D5O), 12060042 (D5I), 12060060 (D6/D9)].

A. O-ring seal plates (3) for cryostat base castings. It is preferred that these seal plates be secured to the base castings through use of dog brackets which attach to the inside recessed shoulder of the base castings.

B. O-ring seal plates (2) for cryostat vacuum vessel. It is preferred that these plates, used to seal to the ends of the cryostats, index to the cryostat on the ID of same, and are machined flush to the OD dimension of the cryostat vacuum vessel.

C. Vacuum manifold (1), with minimum conductance of 50L/sec, for connecting turbomolecular pump to cryostat vacuum vessel pumpout port.

D. Turbomolecular pumping system (minimum 100 L/sec).

E. Helium mass spectrometer leak detector with minimum discernable signal of 5×10^{-10} Atm.cc He per sec.

F. Bottled helium.

G. Black vinyl electrical tape, type 3M No. 33 plus or equivalent.

H. Methyl alcohol.

I. Lint free tissue.

3.2 Assembly, Electro/Mechanical [Drawing 12010004 (Arc), 12010332 (D5O), 12010333 (D5I), 12010331 (D6/D9)]

A. O-ring seal-plate (3).

B. O-ring seal-plate with pumpout port (1).

C. Vacuum manifold (1) for connecting turbomolecular pump to item B.

D. Turbomolecular pumping system (minimum 100 L/sec).

E. Helium mass spectrometer leak detector with minimum discernable signal of 1 x 10^{-10} Atm.cc He per sec.

F. Bottled helium.

G. Items G - I of Section 3.1.

4. General Requirements:

4.1. Leak Checking

4.1.1 Sensitivity - Leak checking will be performed with Helium Mass Spectrometer leak detector to determine conformance with this specification. When leak checking vacuum vessel assemblies or components (any item with a leak rate requirement of $\leq 1x10^{-9}$ Atm.cc He/Sec specified on the engineering drawing), the leak detector must have a sensitivity for Helium leak rates of $5x10^{-10}$ Atm.cc He/sec. The minimum discernable signal which constitutes a leak is defined as one with a signal-to-noise ratio greater than or equal to two (2). When leak checking cold mass assemblies or components, or helium pipe assemblies or components (any item with a leak rate requirement of $\leq 2x10^{-10}$ Atm.cc He/sec. specified on the engineering drawings), the leak detector must have a sensitivity of $1x10^{-10}$ Atm.cc He/sec.

4.1.2 Pressure - The pressure at the input to the turbomolecular pump must not be greater than 10^{-4} Torr at the time of leak testing.

4.1.3 Elastomers - O-rings may be used as temporary seals for leak detection. No lubricants or greases of any kind are to be used on the O-ring seals on cold mass or helium pipe components. After leak checking, the ends of the tubes must be wiped with methyl alcohol and clean lint free paper and wrapped with aluminum foil.

4.1.4 Bagging - Subsequent to evacuation, parts are to be completely enveloped in a plastic or air tight bag. The bag is then to be pressurized with an atmosphere of helium while the component is connected to the leak detector. This defines the term bagged or bagging. The cold mass (electro/mechanical) assembly shall be bagged for a minimum of one hour.

All other cold mass components, and helium pipe assemblies and components (any item with a leak rate requirement of $\leq 2x10^{-10}$ Atm.cc He/sec. specified on the engineering drawings) will be bagged for a minimum of 15 minutes during leak testing. There may be no indication of a leak during this operation.

To eliminate problems of helium permeation through elastomers, the bagging shall be arranged to exclude these elastomers from the bagged volume.

4.1.5 Calibration - The leak detector used must be calibrated at the beginning and ending of each working shift and records must be kept of the calibration process. The Seller will permit the Buyer to see these records, on request.

4.1.6 Recording - The leak checking of each of the items described in Section 1.1 must be recorded on hardware specific, manufacturing travelers accompanying the item. Data to be recorded will include: 1) the serial number of the leak detector used; 2) the date; 3) the name or initials of the person(s) conducting the leak check.

4.1.7 Required Use of Turbomolecular Pump - Special care must be taken not to contaminate the parts with backstreaming rough pump oil. Therefore, all leak checking must be done with the leak detector connected to the roughing side of a turbo molecular pump (TMP). During pump down from atmosphere, the TMP must be running at full speed when the pressure in the assembly is < 0.5 Torr. The TMP roughing pump must be valved out from the system and the TMP rough pumped exclusively with the leak detector throughout leak testing.

4.1.8 Venting After Leak Checking - After leak checking, the chamber assembly is to be vented to atmospheric pressure with dry, high purity (99.99%) water pumped nitrogen bottled gas or nitrogen from an evaporated liquid source. The vacuum venting valve is to be separate from the pumping system to prevent pump oil from being blown into the chamber assembly when the assembly is being vented.

4.2 Clean Assembly Procedures for the Cold Mass Assembly and all Welded Assemblies.

After cleaning, all components shall be handled in accordance with their intended use in an ultra-high vacuum system. They shall be kept free of smudges and blotches which might stem from handling and contact with dirt or oil. The following are guidelines which shall be followed to keep the assemblies and components from being contaminated:

4.2.1 Assembly, welding, inspection, and packaging shall take place in a dedicated clean area. The requirements for this area are that at a minimum it shall not be located near machine tools, compressors, oily or dirty parts and tools, etc. which can contaminate the work area with hydrocarbons and dirt. In addition, no eating, drinking, or smoking shall be permitted in this area.

4.2.2 All tools and inspection gages which come in contact with the clean components should be degreased and cleaned prior to their use. When the tools are not in use, they should be covered and stored to prevent their use on dirty parts. Tools may not be made of materials which can contaminate the clean parts (e.g. brass, plastic, zinc, and cadmium).

4.3 Welding Procedures for the Cold Mass Assembly and all Welded Assemblies

All components shall be cleaned prior to welding and the vacuum welds should be completed within 48 hours of the cleaning. Cleaning, painting or wiping with solvents of this assembly after welding and prior to leak checking is not permitted.

All welding is to be performed in a clean area and the welders must follow the guidelines specified in Section 4.2 of this specification. All jigs, fixtures, and heat sinks must be clean. Only clean stainless steel brushes are to be used for removing oxides off of welds. Power driven brushes, abrasive papers and abrasive wheels are not to be used.

5. Acceptance Tests:

BNL reserves the right to perform Acceptance Tests which include, but are not limited to, those described in this specification. These tests may be performed on any assembly to determine conformance with the requirements of this specification. These tests will be performed at BNL at no cost to the Seller. But, any chamber assembly which fails to meet the requirements of this specification will be returned to the vendor for repair or replacement.

6. Quality Assurance Requirements:

The following sections of the BNL SELLER QUALITY ASSURANCE REQUIREMENTS, BNL-QA-101, dated January 2, 1987, apply in the execution of this contract:

6.1 Section 3.1.2, MIL-I-45208, "Inspection System Requirements".

6.2 Sections 4.16, 4.23, 4.31, and 4.32.

This quality assurance program must be in existence at the Seller's place of business at the time that the bids are received for the chamber assembly.